TII:

Special Purpose Devices

Unclassified

2 Hour Conference, W/ 3Hr PE1

Safety & Environmental Impact is "LOW"

TII: Special Purpose Devices

Terminal Learning Objective

Action: Identify the elements of UJTs and SCRs and operational concepts of support components, and answer all questions pertinent to the above.

Condition: W/O reference.

Standard: A Minimum accuracy of 70% ,

TII: Special Purpose Devices

Introduction

Since the development of the transistor, continuous research in the field of semiconductors has provided many additional semiconductor devices. Some if these devices have been adopted to applications that were normally impossible. These devices, now considered as innovations in military and commercial equipment, may become as commonplace as the junction transistor is today. Indications are that development and applications for solid state devices will continue to expand. In all cases, where other devices were previously used, the solid state devices are smaller, more efficient, less expensive, and more reliable.

Two of these devices, the uni-junction transistor (UJT) and the silicon controlled rectifier (SCR), will be discussed in detail during this lesson.

TII: Special Purpose Devices

2 Types; Silicone Controlled Rectifier, [**SCR**]

Unijunction Transistor, [**UJT**]

Both are classified in the family of electronic switches called, Thyristors.

Electronic Switches are;
1. Faster
2. Less Expensive
3. Last Longer
4. Have No Arc or Spark as do manual switches & relays.

Applications SCR;
1. High Voltage & Current

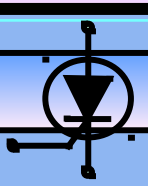
>2000 V & >1500 A

2. Speed Controls for motors

Applications UJT;
1. Trigger for an SCR

TII: Special Purpose Devices

SCR; Silicone Controlled Rectifier.



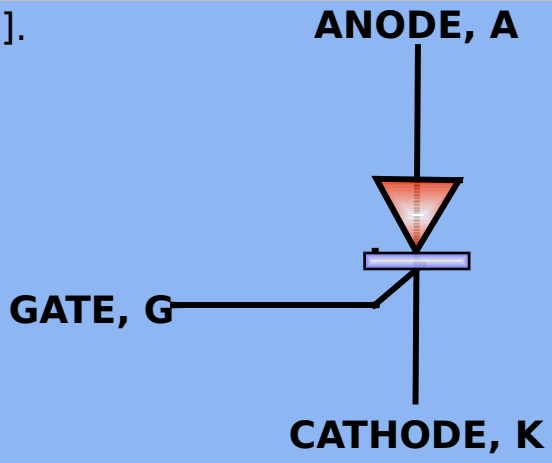
4 Layer PNPN Device, W/3 PN Junctions.

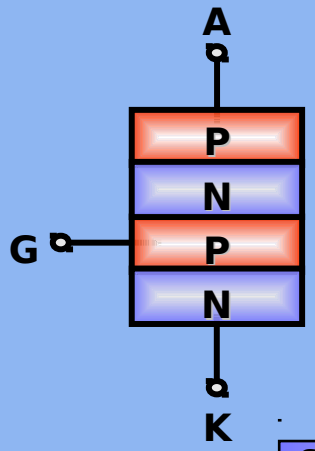
Looks like a diode, acts like a diode, current flows like a diode, W/ an extra element called a Gate.

A small + DC or + spike applied to the Gate will turn on [Gated On] the device provided forward biasing is set on the Anode & Cathode. Once ON, Stays ON.

To Turn OFF, forward biasing must be removed or reversed Biased.

The GATE WILL NOT SHUT DOWN conduction. [Latching Current must be removed].





SCR, Gated ON

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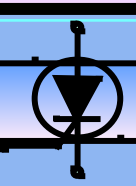
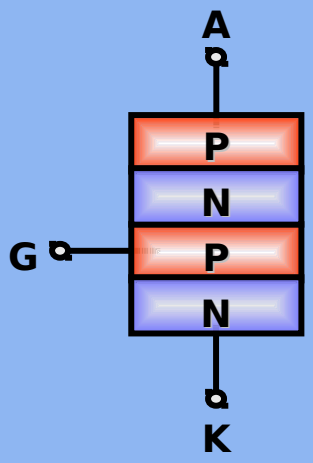
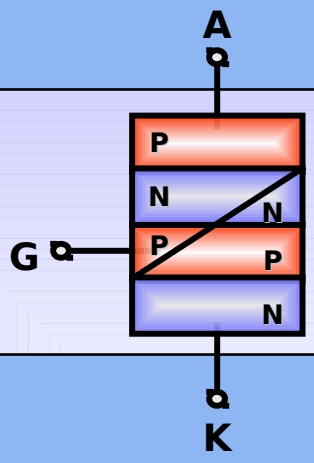
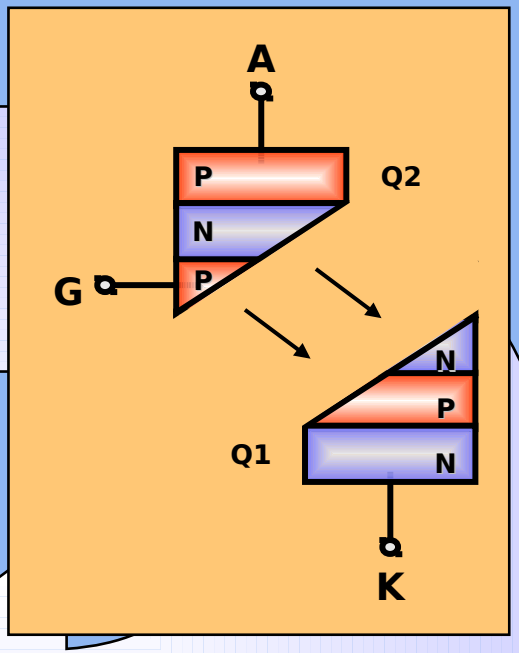
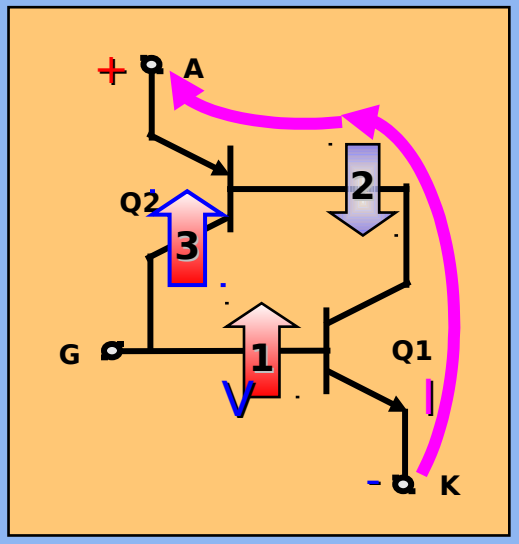
SCR; Gated On, Latched On.











SCR, Power

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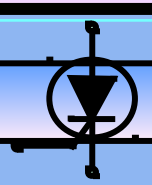
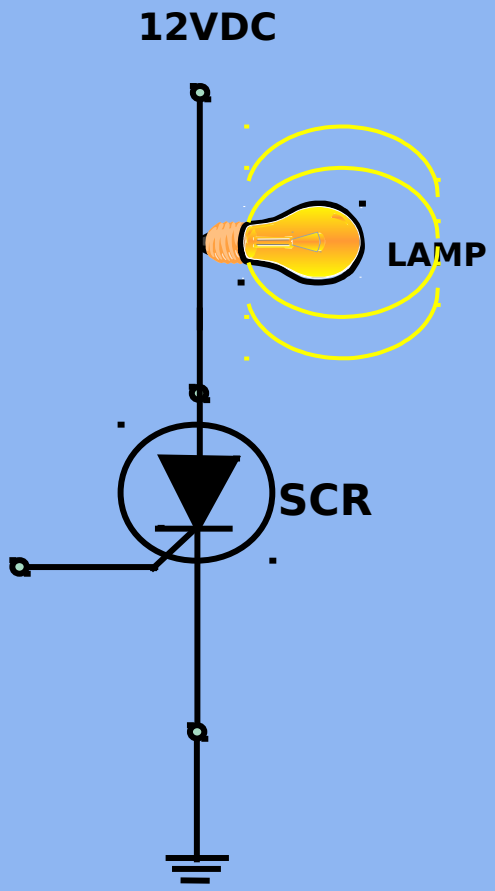
SCR; Efficient Power use.





$P = I \times E$

$P_{LAMP} = I_{LAMP} \times E_{LAMP}$

$P_{LAMP} = 50\ ma \times 11v$

$P_{LAMP} = 550\ mW$

$P = I \times E$

$P_{SCR} = I_{SCR} \times E_{SCR}$

$P_{SCR} = 50ma \times 1v$

$P_{SCR} = 50\ mW$

PC; 52A

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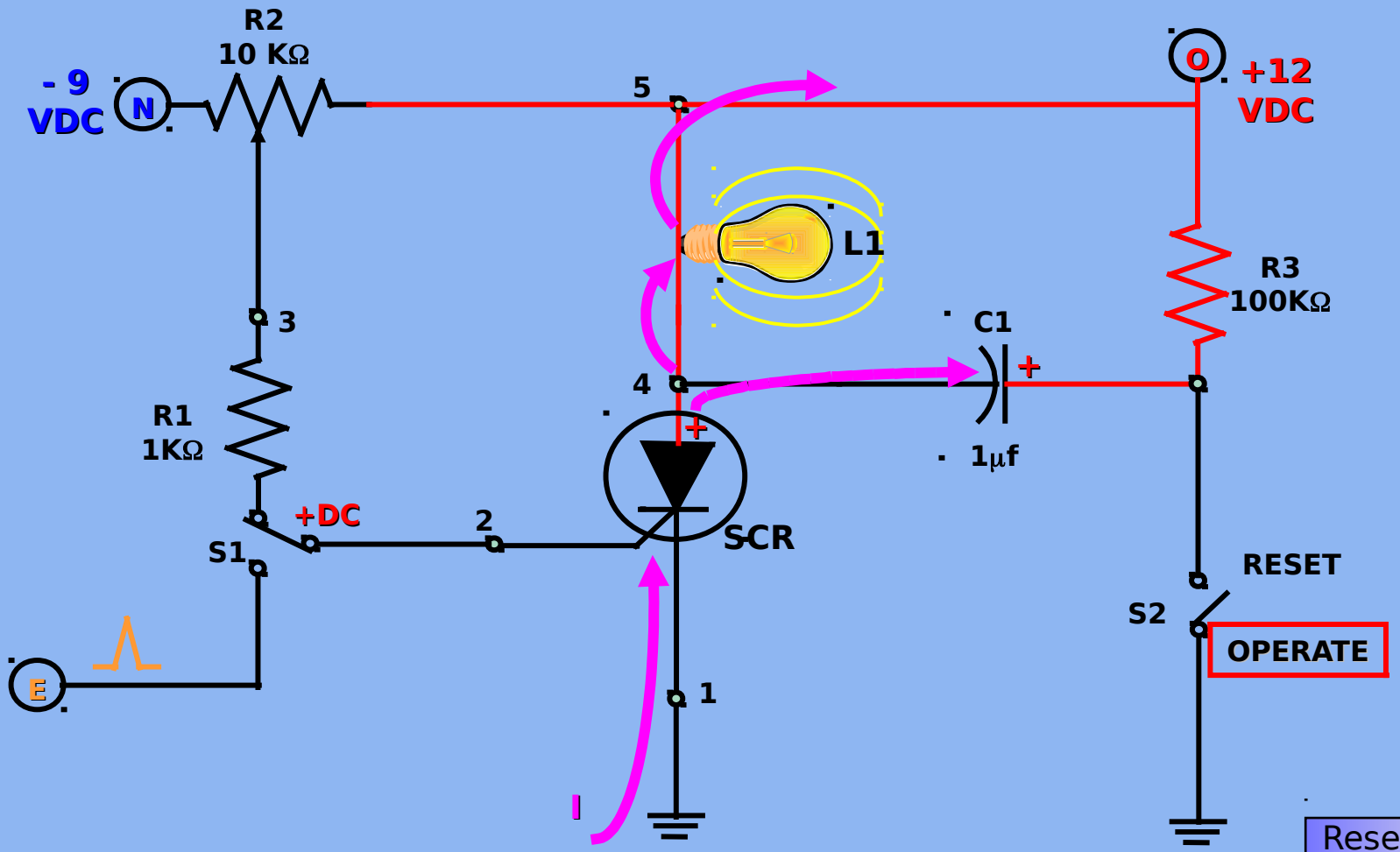
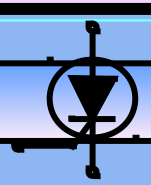
SCR; Control Ckt PC 52A. Operate Mode.

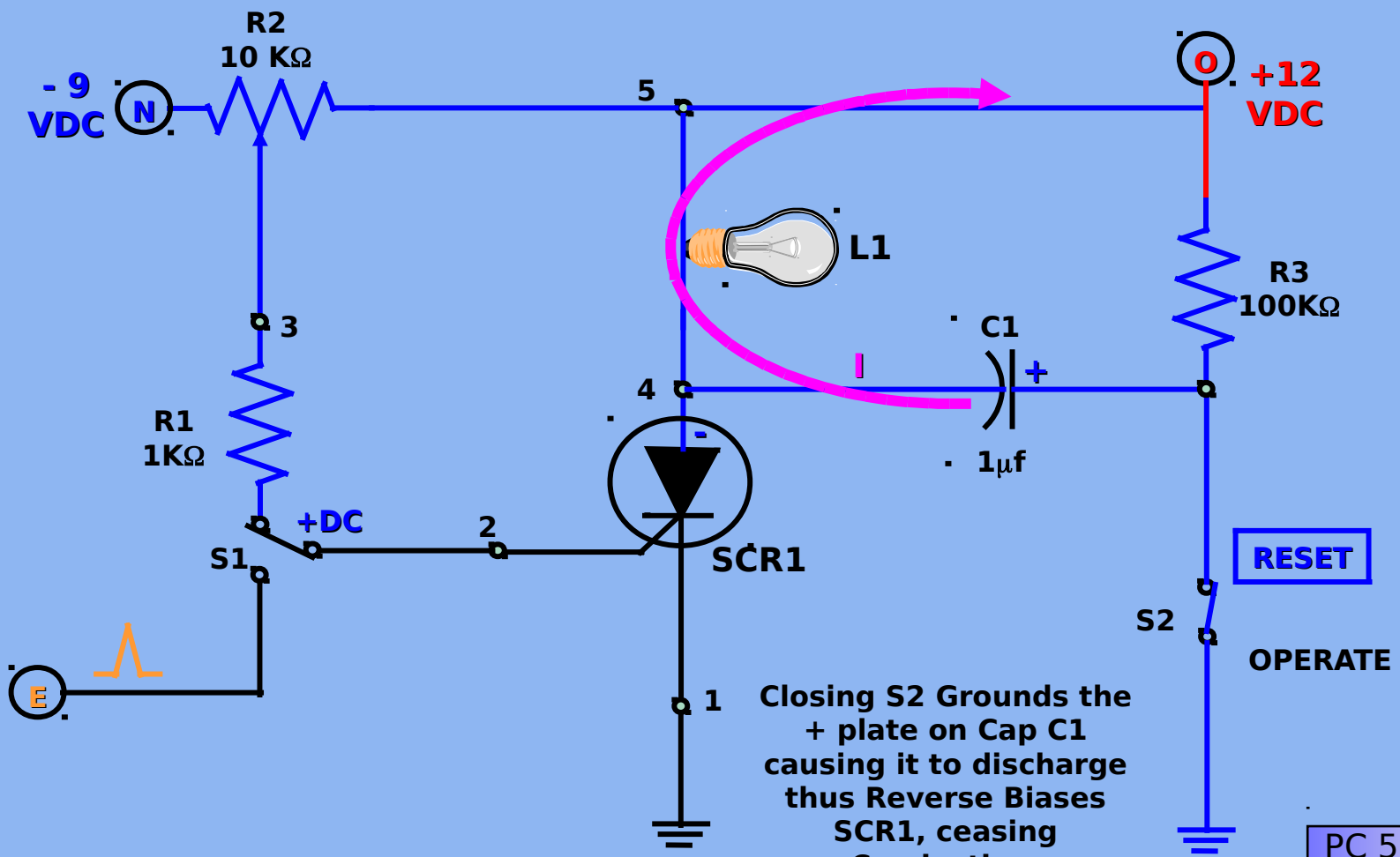


Reset

TII: Special Purpose Devices

SCR; Control Ckt PC 52A. Reset Mode.

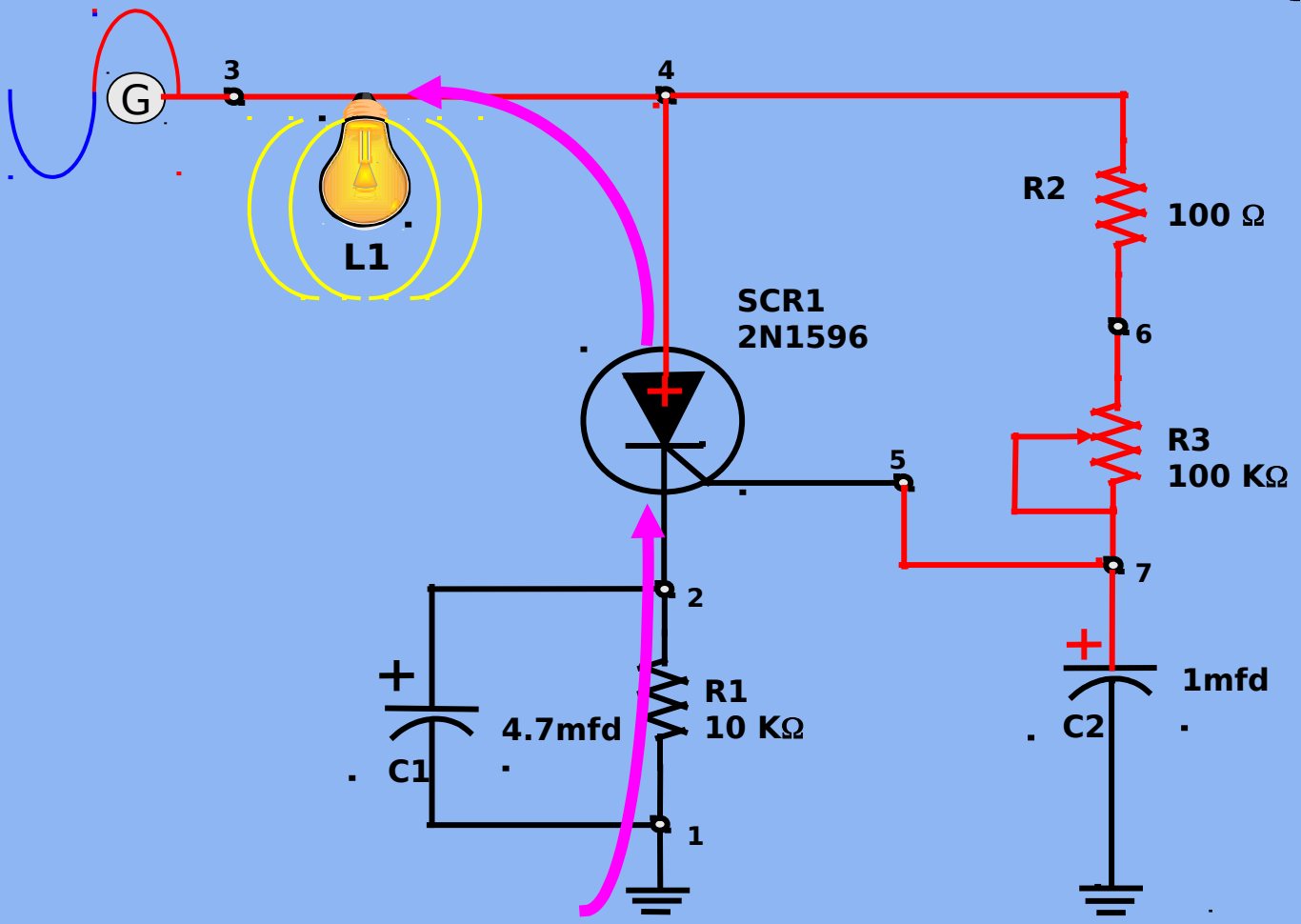




PC 52B

TII: Special Purpose Devices

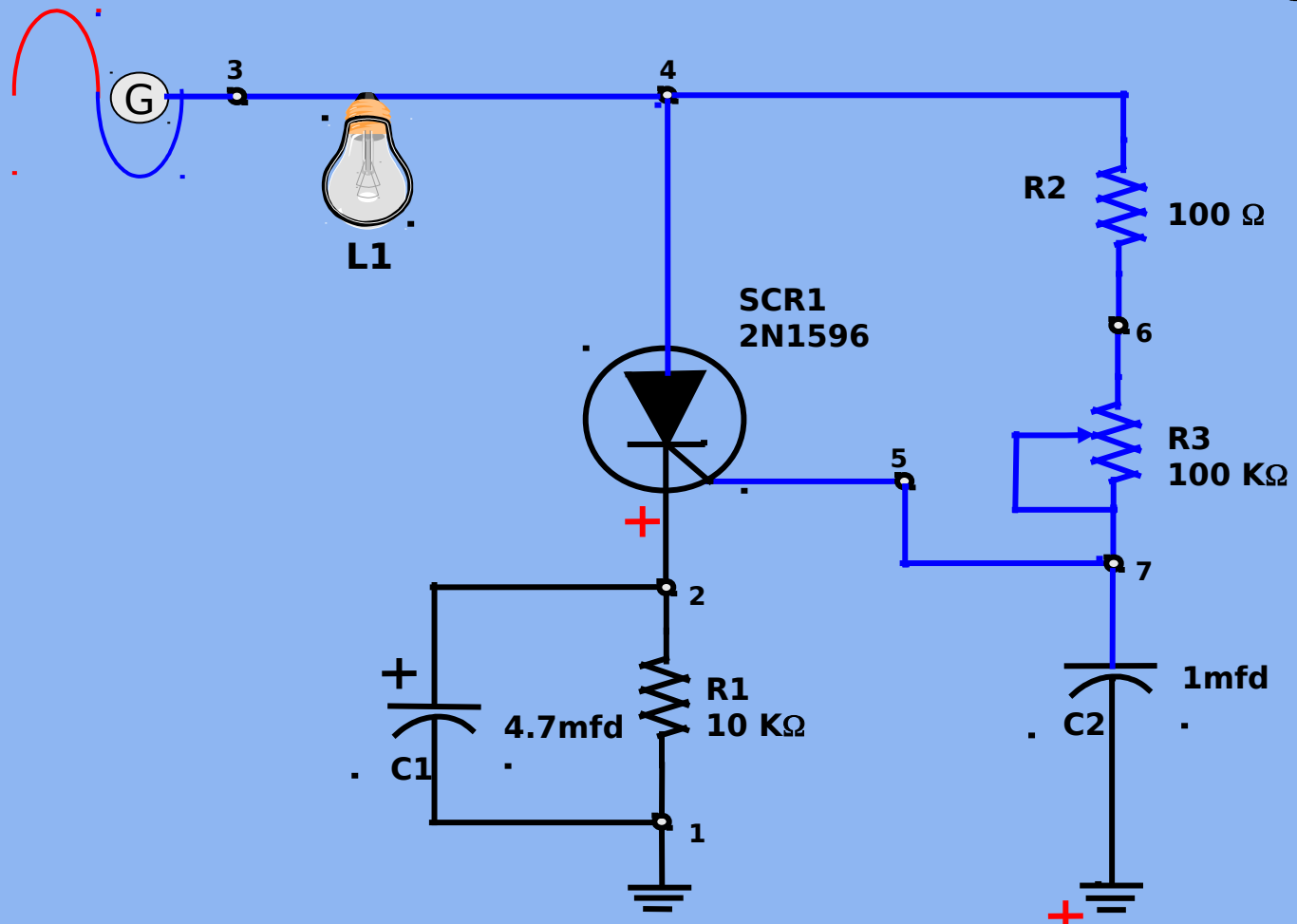
SCR; Ckt PC 52B. Conducting.



PC 52B, Cutoff

TII: Special Purpose Devices

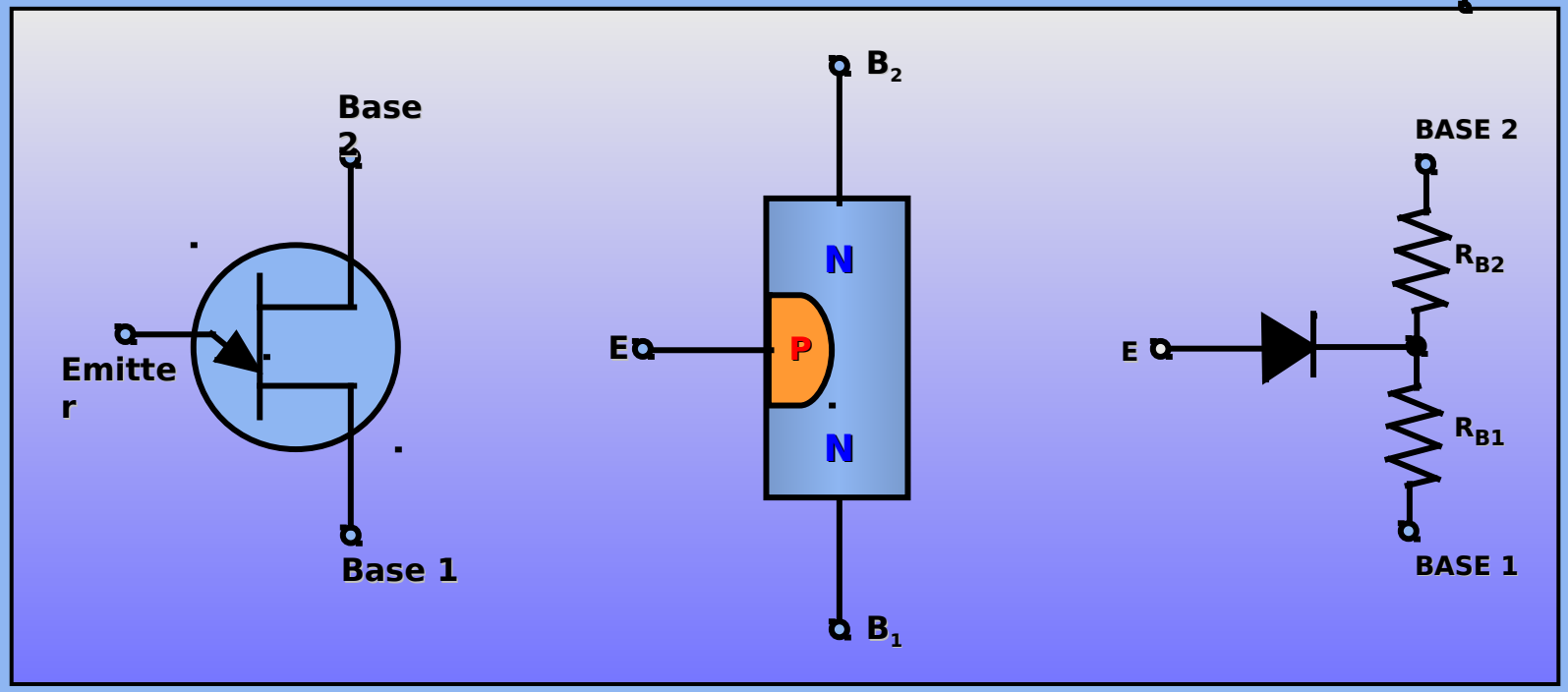
SCR; Ckt PC 52B. Cutoff.



UJT

TII: Special Purpose Devices

UJT; Unijunction Transistor



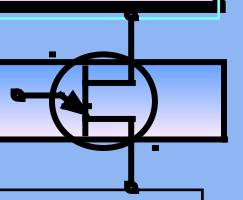
NITA LESSON;

Per Instructor Discretion.

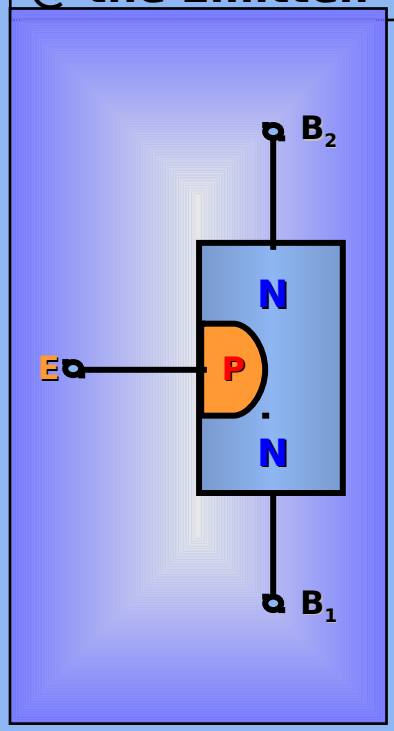
Continue UJT

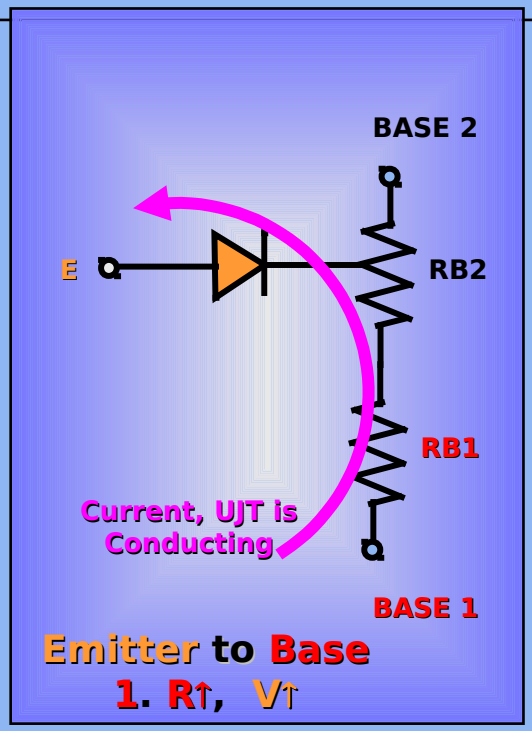
TII: Special Purpose Devices

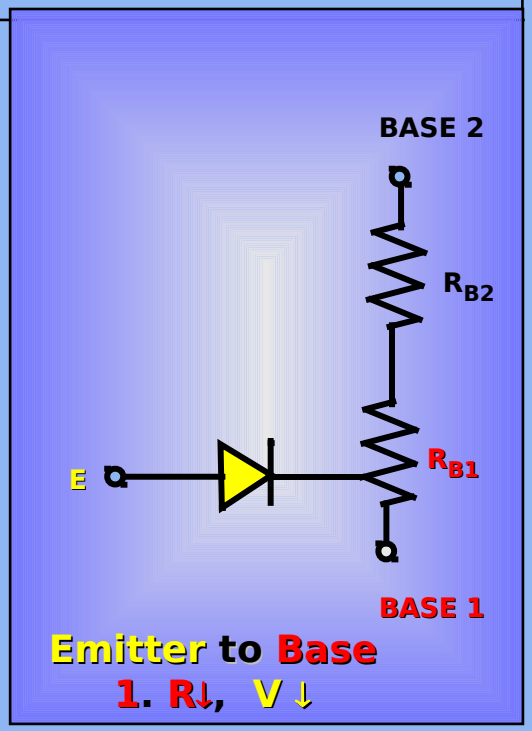
UJT; Unijunction Transistor



The position of the emitter fusing on the N material determines how much voltage is required to turn on the UJT @ the Emitter.







Continue, UJT Ops

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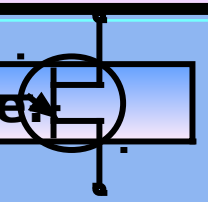
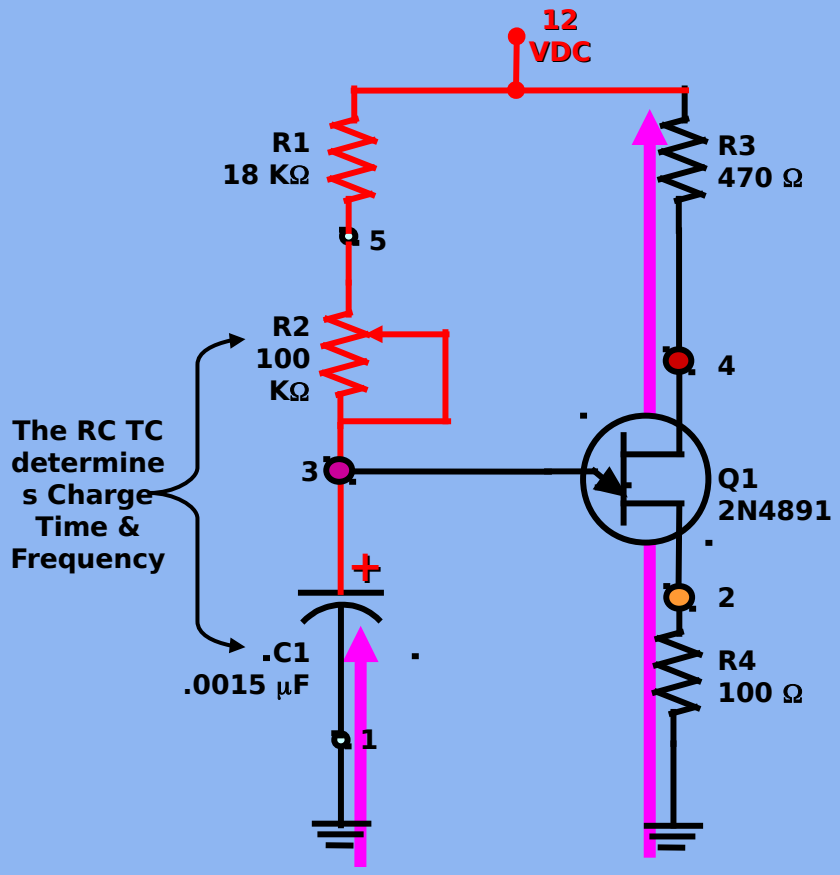
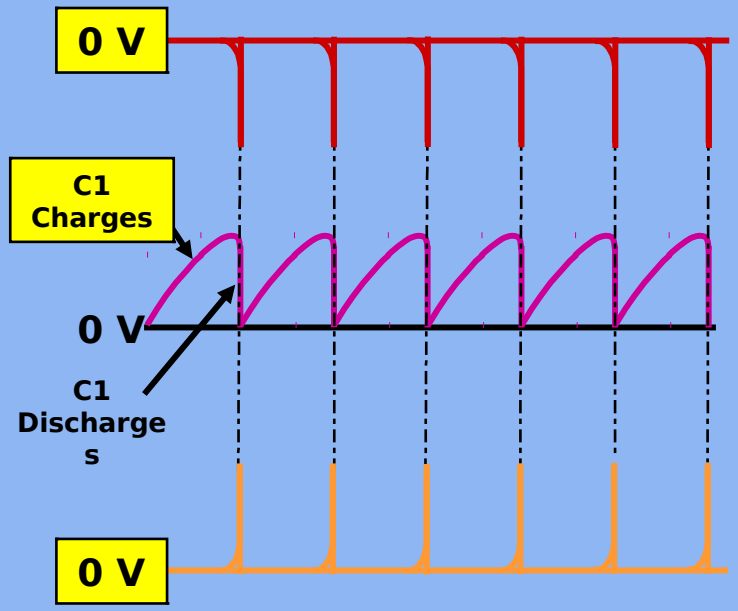
UJT; Oscillator PC 51 . Operation, C1 Charges







C1 Discharge

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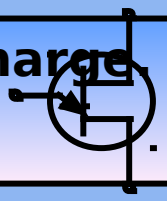
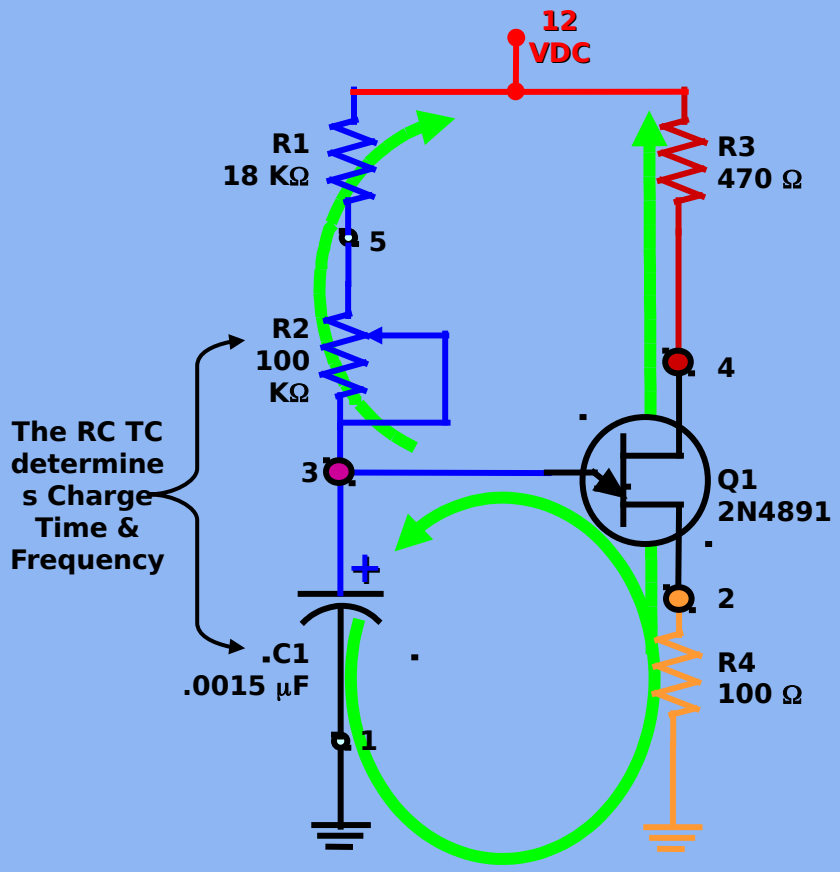
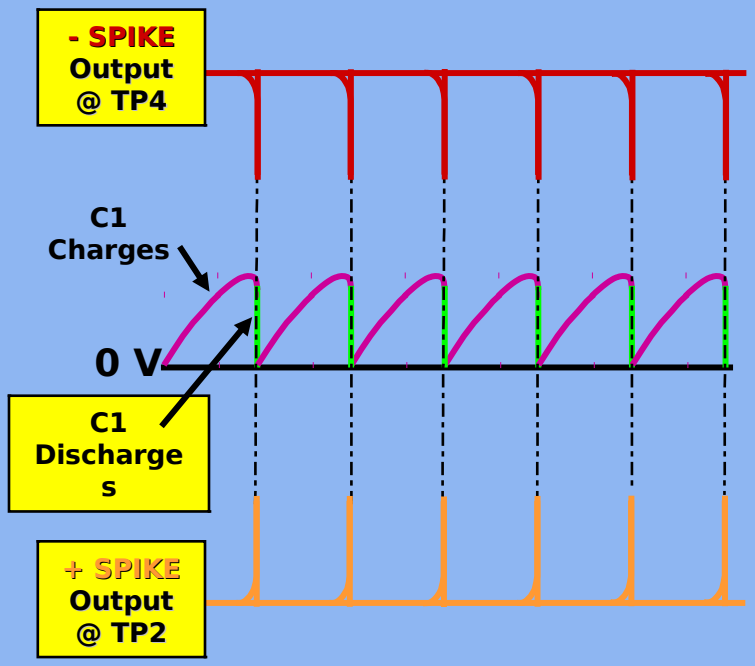
UJT; Oscillator PC 51 . Operation, C1 Discharge.

Output; + & - Spike. Saw tooth @ TP3.







Trouble Shoot

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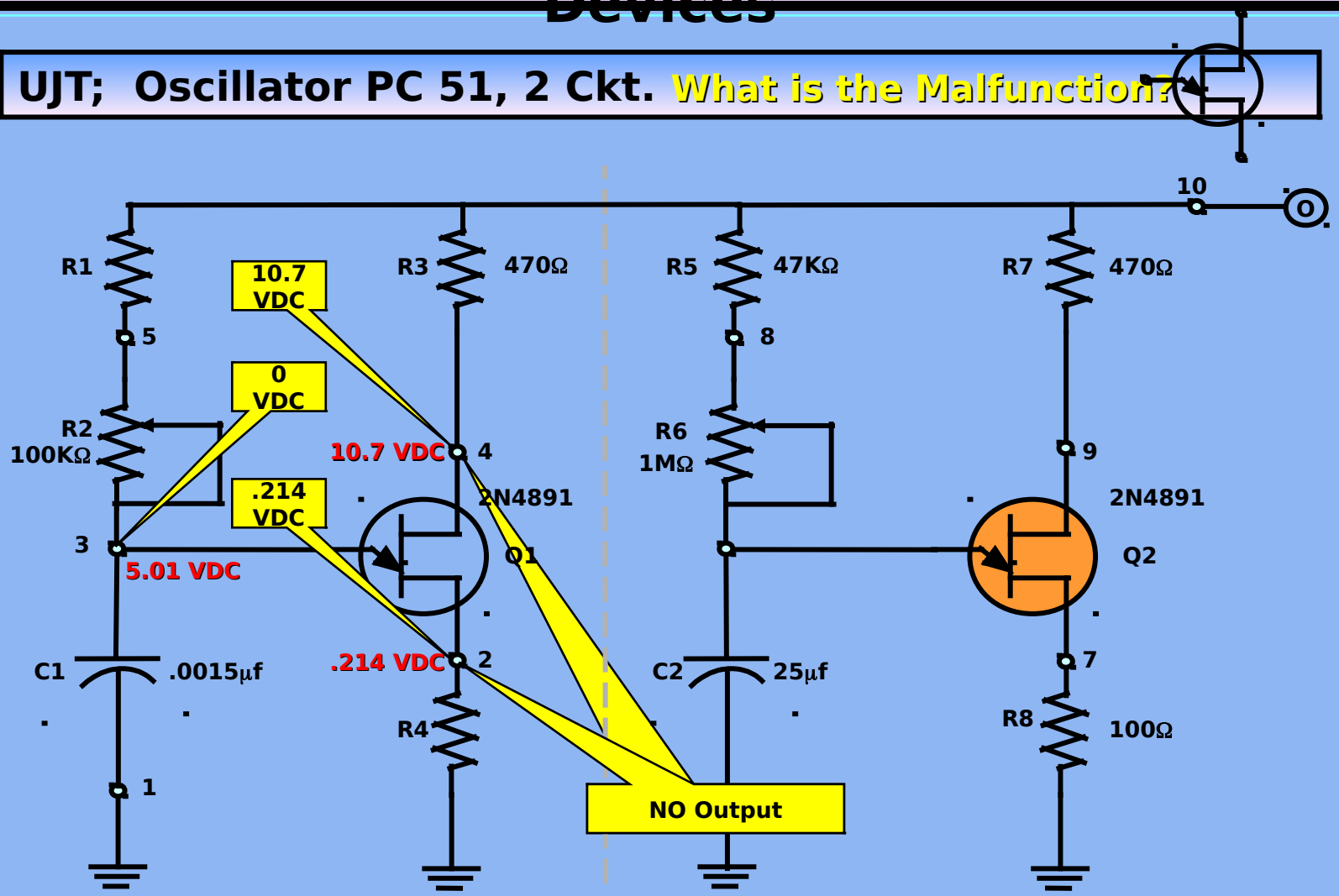
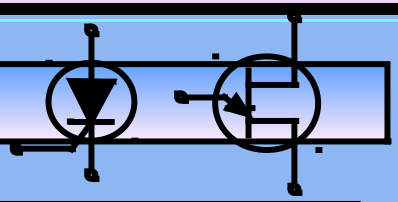
UJT; Oscillator PC 51, 2 Ckt. What is the Malfunction?



Terms

TII: Special Purpose Devices

SCR & UJT; Terms.



SCR; Silicon Controlled Rectifier.

Referred to as a Gated Diode.

To Turn ON, F Bias + on Gate Cathode junction.[Gated On]

To Turn OFF, R Bias Anode/ Cathode thus removes Latching current.

Latching Current, the minimum amount of current that can flow through an SCR and hold it in the Break over condition or conduction.

UJT; Unijunction Transistor.

Referred to as a Double Based Diode.

Location of the emitter joined to the N material [PN Junction] determines the amount of voltage required @ the emitter to cause conduction through the Emitter.

3 Waveforms Produced, + & - Spike, Saw tooth.

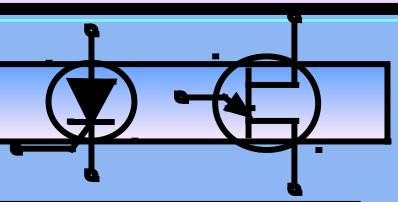
Main Use, Oscillator & Switching Trigger.

SCR & UJT; Both in the Family called Thyristors, [Electronic Switches].

Review Questions

TII: Special Purpose Devices

Review Questions;



1. One of the main uses of a UJT is as a _____, _____ .
2. Why is the UJT often used instead of a conventional transistor?

   _____ .
3. The UJT is also called a _____ _____ _____ .
4. What is the Basic purpose of a SCR? _____ _____ .
5. How is an SCR turned on ? _____ .
6. What family of transistors does the SCR & UJT belong to ? _____ .
7. Draw the schematic symbol for a UJT & SCR.

8. How many PN Junctions does the SCR contain ? ___ .
9. How is an SCR turned Off ? _____ _____ _____.

Answers; 1- 9

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Review Questions;

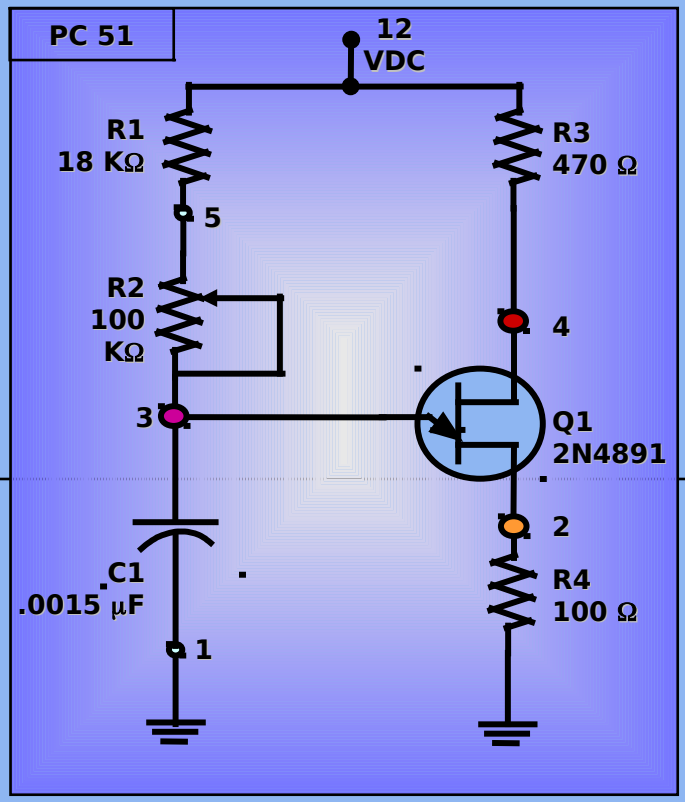
10. Refer to PC 51; The following DC voltages are present: TP4 = 10.7 VDC, TP3 = 0 VDC, TP2 = .21 VDC. What is the Malfunction ?

    a. C_1 Open

    b. R_1 Open

    c. R_2 Short

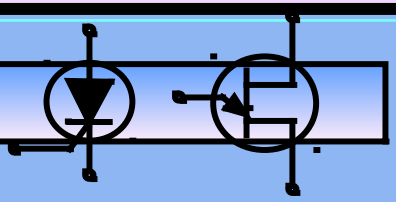
    d. Q_1 Open



Answer; 10

TII: Special Purpose Devices

Lesson Test;



Lesson Test:

Standard: 10 Questions W/in 20 Minutes. 70% Minimum Accuracy. Reference: None.